ENGINEERING

Regional Supervisor, Division of Wildlife Refuges

March 25, 1969

In reply refer to:
EH-R-Tewaukon

Regional Engineer

1969 Annual Water Program - Tewaukon NWR

The 1968 water use summary and physical developments and progress on the refuge are well presented, both in writing and pictorially.

A large runoff in 1969 appears imminent as the mid-March snow survey shows from four to six inches of water content on the contributing drainage basin.

In regard to the refuge manager's comments on the problems with pool 3 dike: The northwest side of the dike should be designed to withstand levels at elevation 1156. Engineering should survey, design a section, and advise refuges of requirements. This item is in the development plan, but could be accomplished with O&M funds. Riprap maybe required to protect the upstream side of the pool 3 dike against river flows.

We are attaching a sketch of an idea for a Carp screen suggested by one of our engineers, Carl Vaurio. The suggestion is a result of pictures and comments regarding the ineffectiveness of the present barriers, when tailwater levels rise and drown out stoplogs in refuge control structures.

As indicated by Mr. Vaurio, the center two carp screens on pool 2 structure (photos 12 and 13) may have to be linked together to "over lap" the pier area to prevent carp from leaping across the screen at these locations.

John D. Umbarger

Attachments

cc: Refuges--RO

CWStephan:ce

Stephan 3-28-69

Severson 3/31/69

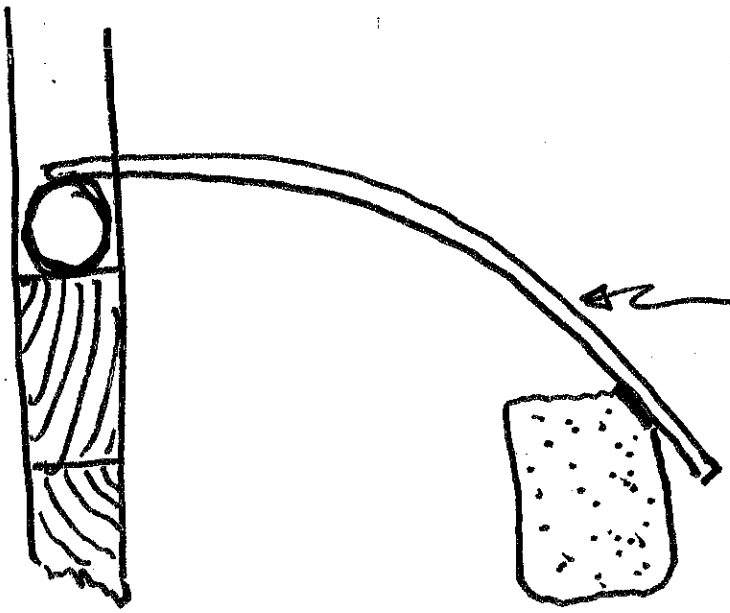
Wright 3-26-69

JDU 3/26

Pictures of Annual Water Program filed in Photo Index

CEV. 3/21

Carp Screen



5/8" ϕ rods spaced 1 1/2" on centers welded to 3" I.D. pipe that fits into stoplog slot & to 1/4" x 2" steel strap at lower end. Flotation device can be fastened to this strap. Flotation either urethane or small steel drum or half circle drum.

In theory the carp swim under the flotation device & are prevented from passing thru stoplog opening. High tailwater raises the lower end of the screen to stop migration; it may be necessary to install a holddown in the stoplog slot to prevent upward thrust of pipe, however.

Also the center two screens may have to be linked together (temporary clamp) to prevent carp from leaping across near the pier

I. 1968 Water Use Data

IMPOUNDMENT DATA

Pool 1, Lake Tewaukon for Calendar Year 1968
(flow line elevation 1140)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	5.45*	1145.45	1,140	6,500
Feb.	5.45*	1145.45	1,140	6,500
Mar.	5.58	1145.58	1,150	6,700
Apr.	5.73	1145.73	1,160	6,850
May	6.08	1146.08	1,180	7,150
June	6.34	1146.34	1,200	7,500
July	6.68	1146.68	1,220	8,000
Aug.	6.36	1146.36	1,200	7,500
Sept.	6.17	1146.17	1,185	7,350
Oct.	6.62	1146.62	1,220	8,000
Nov.	6.85	1146.85	1,235	8,200
Dec.	6.90*	1146.90	1,235	8,200

Pool 2, Cutler Marsh for Calendar Year 1968
(flow line elevation 1144)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	45.42*	1145.42	57	38
Feb.	45.42*	1145.42	57	38
Mar.	46.05	1146.05	75	77
Apr.	46.66	1146.66	103	130
May	49.80	1149.80	220	598
June	51.58	1151.58	266	975
July	51.54	1151.54	265	972
Aug.	51.05	1151.05	250	811
Sept.	50.63	1150.63	242	745
Oct.	48.88	1148.88	183	400
Nov.	47.39	1147.39	134	208
Dec.	47.35*	1147.35	133	203

Pool 3, Maka Pool for Calendar Year 1968
(flow line elevation 1148)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	51.40*	1151.40	34	115
Feb.	51.40*	1151.40	34	115
Mar.	51.27	1151.27	33	112
Apr.	52.39	1152.39	105	205
May	54.78	1154.78	117	470
June	53.19	1153.19	108	290
July	53.58	1153.58	111	330
Aug.	53.31	1153.31	109	300
Sept.	53.03	1153.03	108	270
Oct.	53.14	1153.14	108	280
Nov.	53.04	1153.04	108	270
Dec.	53.00*	1153.00	108	265

+ Outlet reading * Reading, top of ice

Pool 4 for Calendar Year 1968
(flow line elevation 1151.50)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	52.00*	1152.00	10	20
Feb.	52.00*	1152.00	10	20
Mar.	52.20	1152.20	10	22
Apr.	56.88	1156.88	46	160
May	58.36	1158.36	76	230
June	58.25	1158.25	73	220
July	58.29	1158.29	75	225
Aug.	57.95	1157.95	68	207
Sept.	57.73	1157.73	62	195
Oct.	58.13	1158.13	70	212
Nov.	58.11	1158.11	70	211
Dec.	58.10*	1158.10	70	210

Pool 8, Hepi Lake for Calendar Year 1968
(flow line elevation 1174.50)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	5.13*	1175.13	105	315
Feb.	5.13*	1175.13	105	315
Mar.	5.12	1175.12	105	315
Apr.	5.04	1175.04	105	302
May	4.90	1174.90	104	290
June	4.73	1174.73	104	275
July	4.54	1174.54	101	255
Aug.	4.16	1174.16	94	220
Sept.	3.93	1173.93	90	195
Oct.	3.89	1173.89	90	195
Nov.	3.80	1173.80	88	185
Dec.	3.80*	1173.80	88	185

Pool 11, West White Lake for Calendar Year 1968
(flow line elevation 1145)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	48.00*	1148.00	42	67
Feb.	48.00*	1148.00	42	67
Mar.	47.97	1147.97	41	66
Apr.	48.07	1148.07	43	71
May	49.81	1149.81	65	167
June	50.37	1150.37	71	204
July	50.48	1150.48	72	213
Aug.	50.03	1150.03	67	180
Sept.	49.62	1149.62	63	153
Oct.	49.53	1149.53	62	146
Nov.	48.11	1148.11	43	74
Dec.	47.60*	1147.60	37	52

* Reading taken on top of ice. + Outlet reading

Pool 12, East White Lake for Calendar Year 1968
(flow line elevation 1146.80)

Month	Gauge Reading + (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	47.80*	1147.80	101	380
Feb.	47.80*	1147.80	101	380
Mar.	47.77	1147.77	101	378
Apr.	47.73	1147.73	101	372
May	47.70	1147.70	101	370
June	47.92	1147.92	102	395
July	48.17	1148.17	102	415
Aug.	47.98	1147.98	102	398
Sept.	47.99	1147.99	102	399
Oct.	47.51	1147.51	101	350
Nov.	47.40	1147.40	101	340
Dec.	47.60*	1147.60	101	360

Pool 13, Mann Lake for Calendar Year 1968

Month	Gauge Reading (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	7.85*	1207.85	41	151
Feb.	7.85*	1207.85	41	151
Mar.	8.06	1208.06	43	161
Apr.	9.13	1209.13	48	208
May	10.00	1210.00	52	250
June	9.80	1209.80	51	240
July	9.69	1209.69	51	224
Aug.	9.01	1209.01	48	202
Sept.	8.78	1208.78	47	192
Oct.	8.79	1208.79	47	192
Nov.	8.84	1208.84	47	195
Dec.	8.85*	1208.85	47	195

Pool 14, Sprague Lake for Calendar Year 1968

Month	Gauge Reading ** (average)	Elevation (feet)	Area (acres)	Capacity (acre-feet)
Jan.	4.50*	1210.50	167	887
Feb.	4.50*	1210.50	167	887
Mar.	4.76	1210.76	168	894
Apr.	5.46	1211.46	175	968
May	5.91	1211.91	178	1,037
June	5.95	1211.95	179	1,043
July	5.80	1211.80	178	1,020
Aug.	5.39	1211.39	175	961
Sept.	5.24	1211.24	174	940
Oct.	5.29	1211.29	174	945
Nov.	5.20	1211.20	174	937
Dec.	5.20*	1211.20	174	937

* Reading, top of ice. + Outlet reading ** All months are 0.0 on gauge 1206.00.

(Hepi) Small Impoundments, 1968
(Clouds Lake drainage, average monthly readings)

Month	Pool 2A	Pool 3A	Pool 5	Pool 6	Pool 7	Pool 7A
Jan.	(1) dry	1151.40*	dry	1167.45*	1169.00*	dry
Feb.	(1) dry	1151.40*	dry	1167.45*	1169.00*	dry
Mar.	1151.00	1151.76	1160.00	1165.47	1169.48	dry
Apr.	1151.10	1153.14	1160.54	1167.12	1171.98	dry
May	1150.66	1154.45	1162.32	1168.29	1172.28	dry
June	1150.28	1154.16	1162.27	1168.16	1172.13	dry
July	1149.83	1153.79	1161.82	1167.79	1171.85	dry
Aug.	1148.71	1153.13	1161.10	1167.11	1171.27	dry
Sept.	(1) dry	1152.79	1161.28	(2) dry	1170.98	dry
Oct.	(1) dry	1154.45	(3)1161.35	dry	1171.03	dry
Nov.	(1) dry	1154.79	dry	dry	1170.98	dry
Dec.	(1) dry	*1154.77	dry	dry	*1170.90	dry

(1) Dry near gauge, some water in pool. (2) Water drained to Pool 5.
(3) Water released to Pool 3A on 8th. * Gauge reading top of ice.

Tewaukon Refuge, Consumptive Water Use For 1968

Pool	A Avg. Annual Evap.	B 1968 Lake Rise	C Net Gain A+B	D Surface Acres	E Ac-Ft Gain CxD	F Outflow in Ac-Ft	G Total Inflow Ac-Ft E+F
Sprague Lake	2.65'	+.70	3.35	176	590	None	590
Mann Lake	2.65'	+1.00	3.65	49	179	"	179
Pool 12	2.65'	-.20	2.45	102	250	"	250
Pool 11	2.65'	-.40	2.25	63	142	"	142
Pool 10	2.65'	.00	2.65	6	16	"	16
Pool 9	2.65'	.00	2.65	10	27	"	27
Pool 8	2.65'	-1.33	1.32	102	135	"	135
Pool 7	2.65'	+1.90	4.55	16	73	"	73
Pool 6	2.65'	-4.45	-1.80	7	-13	"	-13
Pool 5	2.65'	.00	2.65	10	27	"	27
Pool 4	2.65'	*5.60	8.25	67	553	"	553
Pool 3	2.65'	+1.60	4.25	109	463	"	463
Pool 3A	2.65'	+3.37	6.02	10	60	"	60
Pool 2	2.65'	+1.93	4.58	218	998	"	998
Pool 2A	2.65'	.00	2.65	16	42	"	42
Lake Tewaukon	2.65'	+1.46	4.11	1,190	4,891	*	4,891
Total:					8933+	0	= 8,433

* No discharge from Lake Tewaukon during Calendar Year. However, U.S.G.S. gauging station near Cayuga recorded 848 acre-feet of runoff. This was water which entered the Wild Rice River further downstream of the Tewaukon outlet.

ADDENDUM

The question of acreages of refuge pools has been for the most part resolved. We purchased from the USDA a set of 8" scale aerial photos, to scale, taken July 6, 1968. We planimetered our main pools and their elevation and acreages are:

Pool 1, Lake Tewaukon	1146.65	1,221 acres (to dam)
Pool 2, Cutler's Marsh	1151.60	250 acres
Pool 3, Maka Pool	1153.20	125 acres (whole basin)
Pool 4	1158.30	75 acres (incl. river)
Pool 2A	1150.00	28 acres (whole basin)
Pool 3A	1153.80	10 acres " "
Pool 5	1161.90	10 acres " "
Pool 6	1167.90	6.5 acres " "
Pool 7	1171.95	17 acres " "
Pool 8, Nepi Lake	1174.65	102 acres (water only)
Pool 9	-	10 acres " "
Pool 10	-	6 acres " "
Pool 11	1150.50	67 acres " "
Pool 12	1148.15	103 acres " "
Pool 13, Mann Lake	1209.95	62 acres " "
Pool 14, Sprague Lake	1212.00	183.5 acres " "

In the past Lake Tewaukon's acreage and capacity were interpolated from the previous year's Annual Water Program. These were based on an incorrect Area-Capacity graph. We have drawn a new one based on measured acreage and depth. This agrees closely with Figures 20 and 27 in the Master Plan.

SUMMARY OF 1968 WATER PROGRAM

Spring Run-off

Wild Rice River Watershed

We received little runoff from snow in the Wild Rice River this spring. Most of the pools on the watershed were ice free by March 28th. Because of the lack of snow, water levels in Mann and Sprague Lake had only raised about one foot by mid-April. Water started going over the stoplogs in Pool 4 structure on April 12th, at this time the pool was at 1157.75. Pool 3 did not reach management elevation of 1156.00 until May 14th. Water levels in Pool 2 had raised about one foot through mid-April to 1146.60. Lake Tewaukon raised little during the spring.

White Lake Watershed

Water levels in East and West White Lake were generally stable during spring runoff. Water from T-2 reservoir did not start to flow into West White Lake until April 12th. The lake had only raised .30' by the end of April. There was little raise in the level of East White Lake through April 30th.

Hepi Lake Watershed

It was decided to divert T-2 Watershed Retention Dam water to West White Lake again this year. Excessive rainfall last year prevented grass from establishing in the new channel leading to Hepi Lake. Because of this diversion and lack of snow cover Hepi Lake was almost stable at 1175.00 through April.

The control on Hepi Lake was opened March 25th to allow water to flow to downstream pools 7, 6, 5, and 3A. However, most of the inflow to Pool 3A backed in from Pool 3 due to a leaking control gate. It took considerable time to fill the pools in the Hepi Lake watershed this spring as water in Hepi Lake was only one-half foot above the bottom of the outlet. Little runoff was received in any of the pools from snow. Pool 7A, drawn down after freeze-up last year, did have about a foot of ice in it which melted and ran into Pool 7.

1968 Water Conditions

Wild Rice River Watershed

Water levels in Mann Lake reached a peak elevation of 1210.50 on May 14th. The lake held at 1209+ through mid-August and was at 1208.85 when the lake froze over in November.

The high water reading in Sprague Lake was 1212.10 which was also reached on May 14th. After this time water in the lake receded gradually with only minor fluctuations during the summer and fall. At freeze-up the lake was at 1211.20.

Pool 4, completed late in 1967, held water only in the channel leading to the structure over winter. The peak elevation (1158.50) was reached on May 14th. The pool held above 1158.00 through mid-August. With fall rains the pool level reached 1158.25 at the end of September and was at 1158.10 at freeze-up. Except for the deeper river channel, much of Pool 4 was in the range of 1 to 3 feet deep. The water was clear and teemed with invertebrates. Duck and brood use was high all during the summer. This was to be expected. Newly flooded grassland produces vast amounts of invertebrates. The Pool 4 dike was riprapped during the summer. The creation of Pool 4 did not cause heavier hunting kill at Glarum's pits. In fact, it flooded some of his pits nearest our boundary. The birds used Pool 4 very little during the fall.

Pool 3 was brought up to 1156.0 by May 14th. It was at 1155.90 on May 21st when Ed Nickeson told us water was seeping through the dirt dike at the northwest side of Pool 3 into a lake bed he farms. We pulled stoplogs and dropped Pool 3 to 1154.85 on May 23rd, 1153.90 on May 27th and 1153.20 on May 31st. It remained at 1153.25 and 1153.15 for June and fluctuated upward to 1154.00 in July and was 1153.+ the rest of the summer.

See 5/22 memo

When Pool 3 was filling, it was heavily used by ducks feeding in newly flooded grass. We noted this on a pair count on May 17th and noted very abundant invertebrates in flooded grass. Then when the pool was lowered, apparently the invertebrates concentrated and so did the ducks. This effect was so pronounced that it would appear to be a very good management tool to fluctuate the water level, if water were available for refilling. It probably will be in 1969.

We dug some combination dugout-loafing islands on the southwest shore of Pool 3 in 1968 and these were heavily used by loafing ducks. Some of the dirt piles nearly washed away. We also reseeded the alfalfa strip on the southwest shore of Pool 3 and mowed weeds there. This is for a nesting cover width study. Pool 3 elevation was 1153.00 at year's end. And we repaired the Nickeson dike by filling the downstream (NE) borrow pit with our dragline. The fill will be compacted and added to in the spring, if it doesn't wash away first.

Pool 2, which froze out over winter, did not reach management elevation until the end of May. Logs on the pool were set at 1151.25. Flow out of Pool 2 had ceased by July 31st. A carp barrier was put on the structure before spring breakup. The pool was put into drawdown on October 4th and the elevation at year's end is 1147.35. We did not have to pass water through Pool 2 this year to release water from the White Lakes.

Lake Tewaukon (Pool 1) began the year at 1145.44 elevation and never reached the level the stoplogs were placed at. Water did not run into the pool from the Wild Rice River until May 31st. However, some water did enter the lake by way of the drainage south of Skroch's Bay. Flow

from the Wild Rice River ceased by July 29th. The elevation of Lake Tewaukon was 1146.65 at this time. After Cutler's Marsh (Pool 2) was drawn down and the pumping of White Lakes began the lake elevation climbed to 1146.90. This was the elevation at freeze-up, and is almost 1.5' higher than the lake was last winter. We expect no winter kill. Open water was still present during the first week of December. However, the lake is all frozen over at year's end.

White Lake Watershed

A winter kill of carp in Pool 11 was evident during spring break-up. Water was kept in the pool until the late May and June rains prompted us to pull a few stoplogs on June 12th to prevent flooding of Harold Lee's land. Water level was 1150.53 on this date. The lake receded to 1150.35 by June 28th but July rains brought it up to the high for the year (1150.60) on July 10th. It receded gradually until November 3rd when the water was released to Pool 12 to draw it down to effect a winter kill. At freeze-up the elevation was 1147.60.

Water levels in Pool 12 were about stable until water was let in from Pool 11. This raised the lake elevation only about one-half foot to a high of 1148.20 on July 10th. We attempted to pump the pool down during October and November but between the motor on the pump breaking down and other problems we were only able to lower the lake a little over a foot. At freeze-up the elevation is the same as West White Lake, 1147.60. There is a solid snow cover on the ice, and we hope for a winterkill. There was almost no waterfowl use of Pool 12 during the year.

Hepi Lake Watershed

Water levels in Hepi Lake began receding in May and continued to do so until freeze-up. We attempted to drain some water from the pool during the summer to fill downstream pools but due to low levels (only slightly above the outlet tube) and sub-mergent vegetation plugging the tube we were not able to. At the end of the year the lake elevation is 1173.80.

Pool 7A was farmed and seeded to millet during the summer. The pool was not flooded this fall. We plan to flood this area next spring, attempting to attract more breeding pairs of ducks.

About 3.5' of water was added to the lowered Pool 7 from Hepi Lake during the spring. The impoundment reached a peak elevation of 1172.46 on April 29th. The dike was riprapped during the summer. At freeze-up elevation is 1170.90.

Water was also added to Pool 6 during the spring, from Hepi Lake. It reached peak elevation of 1168.44 on April 25th. No releases from Hepi Lake were possible during the summer. Hence the level of Pool 6 dropped considerably and cattails severely encroached into the shallow upper end of the pool. Water was released from the pool on September 1st and the cattails were sprayed with Dowpon C on September 9th. Because of the width of the growth some areas could not be treated. A good kill was

evident on the treated part. Invertebrates were sampled in this pool at weekly intervals during the summer in connection with a pond management study.

Pool 5, which was dry over winter, was filled to 1162.55 from Hepi Lake. The high reading was on May 14th. In an experiment to increased waterfowl use of our pools, Pool 5 was fertilized by dumping 36 tons of barnyard manure on the dike and along the shore on May 24th. The total was 12 truckloads, 3 of which were placed along the sides of the pool.

Invertebrated life, particularly Daphnia, increased greatly following this. We saw up to six pairs of ducks sitting on the riprap along Dam 5 at one time. There was also a pair of mallards in the tailwater of Dam 5, possibly attracted there by fertilized water seeping through the stoplogs. We sampled the invertebrates by taking a one liter sample of water weekly at six different locations in Pool 5 and two in Pool 6. These samples are being analyzed by Limnologist George Swanson at the NPWRC.

Eyeball estimates of the samples indicated that the invertebrate population declined after a number of weeks. On July 12th we dumped 30 tons of sheep manure around the edge of the pool and pushed it in with the dozer. There did not appear to be a great response to this in increased duck use or zooplankton populations.

District Fishery Supervisor Jon Nelson inspected the pool on October 30th and surmised that the manure greatly increased the filamentous algae and that "indirect competition between plankton and algae for the available nutrients and intolerably high pH values resulting from photo-synthetic activity were thought to be most significant" (in causing a decline in zooplankton).

Another part of the study was that 54,000 seven to eight week old walleye fry were stocked in Pool 5 during the first week of July. It was thought that these fry could be raised to 5 to 6" size for stocking in Lake Tewaukon incidental to waterfowl use of the pond.

Pool 5 was dewatered on October 8th with a fine mesh net on the discharge tube to catch the walleyes. Only about a dozen showed up! Along with them were about 100 stickleback and fathead minnows. A heavy mat of filamentous algae trapped some of them in dewatering, and they probably cannibalized, too.

Nelson believes that to fertilize the pond with chopped alfalfa hay would minimize the production of detrimental filamentous algae. Normally, he said, 300 to 500 pounds of chopped hay or alfalfa per acre foot is adequate.

Pool 3A was unintentionally filled from Pool 3 during the spring. Some leaking took place through the control culvert on 3A which allowed water

to back through from Pool 3. This allowed some minnows to get into the pool. It reached the highest elevation during mid-May, 1154.80. About two feet of water was added to the pool when Pool 5 was drawn down in October. At freeze-up, elevation is 1154.77.

Pool 2A was maintained in drawdown. We tried to disc the bottom with the intention of seeding rye to be flooded in the spring of 1969 for production of Zooplankton. It was too muddy to work, though. Alfalfa was seeded around the border of the pool in August, 1967 and reseeded in the spring of 1968. Weeds were mowed on the seedings.

Potholes

Because of the lack of snow runoff and below normal precipitation, potholes were in poor condition until mid-May. However, above normal precipitation received in late May and through June brought pothole levels up considerably. Water levels in potholes remained good through the third week of July and deteriorated rapidly after that time. Warm, windy weather during a 30 day dry spell (less than .3" received) dropped levels rapidly during August and many potholes dried up. However, with good 1.5" cloudbursts received in September, water in potholes was restored and they remain in good shape at the end of the year. There is also a heavy snow cover, about 18".

Two potholes at the present headquarters were level ditched with a dragline in the fall of 1967. The ditches filled with water in the spring, but there was little duck use there until a load of manure was dumped in the end of each ditch on May 24th. Invertebrate populations (Daphnia in particular) developed in each ditch and pairs began using this water regularly.

The pre-fertilized pair count on Pothole No. 11 (100 yards NE of the old office) was 1 pair of Blue-winged Teal and one drake, and of Pothole No. 13 (100 yards SE of office) was one pair of shovelers. After fertilization by dumping one load of manure in the end of the level ditch in each pothole on May 24th, a pair count June 10th showed Pothole 11 to have one pair of mallards, two pair of blue-winged teal and three lone drakes. Pothole 13 had one drake gadwall and three drake green-winged teal.

A mallard nested within 20 feet of the north shore of Pothole 13, right next to our yard and busy patrol road. She hatched this clutch.

We took water samples in Potholes 11 and 13 at different times and found pockets of Daphnia in several places. But when I took a sample of Pothole 13 on June 21st, the Daphnia were dead. None were found in casual checking after that. Duck use of these areas stopped just before I discovered the dead Daphnia. Only an occasional duck used the potholes the rest of the summer.

A small Type I pothole in a barley field north of Pool 12 had very high duck use for a while in May. Though it was only about 30 feet across and six inches deep, up to 50 gadwalls used it for several weeks. The

birds quit using it before it dried up. Limnologist George Swanson attempted to collect a pair of blue-winged teal feeding on this pothole but a sonic boom scared them off. We did not inspect the water, but George said there was a high invertebrate population attracting these ducks.

Food

Little food was available to spring migrant waterfowl on the refuge. There was very little carry-over because of the hail losses of 1967. Rye browse was used some as were picked corn fields on the Sprague Lake Unit and some standing corn which was knocked down so as to be available to waterfowl. It seemed that most of the geese by-passed the refuge on their return flight north, using the Ludden area in the main.

The early March warm spell prompted many farmers to begin springs work. In fact, wheat was seeded as early as March 7th in the area. A cold spell prevented any other seeding until the end of March.

Invertebrate populations in Pool 10 and newly flooded sedges and grasses in Pools 3 and 4 attracted many ducks during the spring. The upper end of Pool 2 also received good use. Pool 10 receives runoff from Clarence Breker's barnyard, thus it is fertilized. Pool 9 is similar in size and is adjacent but it is not so fertilized, has minnows in it, and receives almost no duck use.

The summer proved to be an ideal growing season for grain crops, with above average yields and early ripening the grain broke down well and food supplies this fall were in good supply.

Drawdown of Pools 6 and 5 concentrated invertebrates which were well utilized by ducks, gulls and waders.

Waterfowl Use

Although little use was made of the refuge by geese during the spring, ducks were here in high numbers.

We made two complete pair counts of ducks this spring and tallied one of our best years. 887 pairs were actually counted, second only to 1962 when 928 were projected to be present. Production was also good with 2,164 young calculated.

Pool 4 received the best use by broods. It held water for the first time this year. A few potholes on the Sprague Lake Unit were highly attractive to pairs and had good numbers of broods on them. Pool 7 had some broods using it but fewer than last year when it was newly flooded.

About 300 to 400 moulting mallards made use of Cutler's Marsh during the summer. Fall duck use of the refuge was highest ever this year, goose use was also good.

Waterfowl feeding on the main unit was primarily in the Cutler's Marsh area. Later the birds moved to harvested corn fields and browse in the Hepi Lake area. Geese and ducks, particularly widgeon used browse fields on the Sprague Lake unit throughout the fall.

Shovelers made extensive use of Lake Tewaukon until freeze-up, feeding in tightly packed groups of 5 to 70, with 3,000 to 5,000 birds present. We assumed they were feeding on plankton, but just what we don't know.

1969 ANNUAL WATER PROGRAM

The Water Program is described for the Tewaukon Unit and for the Sprague Lake Unit. The Tewaukon Unit is described according to water source: Wild Rice River, Direct; White Lake Watershed; and Hepi Lake Watershed.

Tewaukon Unit

I. Wild Rice River Watershed, Direct

Pool 4

This will be filled to 1159.0 at the end of the spring runoff. It should be maintained at a lower level until the peak flow is past to prevent flooding of private land should heavy rains suddenly increase the flow.

Carp should, if possible, be prevented from passing downstream from Sprague, Mann and Silver Lakes by the installation of a carp barrier. We are experimenting with several different types.

The kind of barrier on Lake Tewaukon pictured in last year's report is not a good design. A heavy flow of water causes the guards to "float", allowing carp to come up beneath them. The tines of the guard should point up, which would allow a measure of self cleaning. The flow of water would hold them against the logs. A high tailwater would probably flood the whole barrier, so we still need a barrier that will be effective even when flooded. We are even now at the drawing board!

Depending on the flow of water in the river, we could fluctuate the water level in Pool 4 during the early part of the summer. The idea would be to shallowly flood grass for perhaps two weeks, then drop the level perhaps a foot for a week or more, and then re-flood the grass again.

I am convinced this will result in maximum invertebrate populations and maximum availability to ducks. We have very few diving ducks and do not need a stable water level for their nesting in all pools.

Pool 4 should be managed in such a way that we do not kill out floodable grass. We should hold the pool at less than full so we can briefly flood some grass each spring. It should not be maintained higher than 1158.0 for the summer.

There is no management reason to drawdown Pool 4 for the winter, but one reason to hold it up is to provide muskrat habitat. It could be lowered slightly for the winter, depending on what it looks like following its first winter at 1158.0.

Pool 3

A heavy runoff is expected, so Pool 3 will have to be held at a moderate

level to facilitate passage of flood water. High water should not be allowed to put pressure on the Nickeson dike. As the flow subsides, Pool 3 will be brought up to 1156.0 provided the Nickeson dike does not leak. If it does, the pool will be dropped to about 1153.20. A deep borrow pit against the face of the dike means that as long as there is a flow in the river, there is water against the dike. This would have to be minimized.

This borrow pit is connected to the main river channel and could be blocked off there. The site is against a hill and we may not be able to get a dragline close enough to block it, though.

If the dike does not leak, Pool 3 should be dropped to perhaps 1153.50 within a week after filling. After about a week at this lower level, it should be refilled and again lowered, if there is river flow to permit this variation. The main level for the summer should be an intermediate one, perhaps 1155.0. The idea here is to flood grass to cause a population explosion in invertebrates, partially dewater to concentrate them, and then raise the water again to see if the high invertebrate population can be sustained.

The final pool level should be a moderate one which will not kill out all the floodable grass. This level will best be found by inspection and experimentation.

Pool 3 should go into the winter with water and marsh for muskrat habitat but with unflooded grass in the basin. The moderate summer level should be okay. Carp will probably be present but may winter kill.

Pool 2

We are going to have to manage Pool 2 according to the runoff. Stoplogs should be raised to keep the carp barriers from flooding. Yet water may have to be passed from Pool 12, East White Lake, through Pool 2 into Tewaukon. A heavy runoff from the drainage ditch coming into the southeast corner of Lake Tewaukon will probably fill the lake before the river does.

These appear to be the priorities: (1. Keep Pool 2 low enough to discharge floodwaters from Pool 12 if they occur. Pool 12 should be kept as low as possible, so some water will probably be run from there. (2. Keep the stoplogs in Dam 2 low enough to let the floodwaters pass and yet high enough so the carp barriers do not flood due to the tailwater (Lake Tewaukon).

Pool 2 will probably flood completly, after which it could be dropped by setting the stoplogs so the flow holds the pool at 1151.50. A stoplog setting of 1151.25, same as last year, is adequate with a reduced flow.

I am concerned about flooding the cattail stand in mid-pool, and maybe losing some of the dead trees and logs there. This part of Pool 2 is

the only extensive moulting habitat we have and also provides a good loafing area and shelter from the wind. On our June 10th pair count, we flushed about 250 mallards from this cattail-dead tree area of Pool 2. This same area provides a good wintering area for deer, brood shelter, and something approaching wood duck habitat.

Thus we want to manage Pool 2 to flood grass in the upper reaches of the pool and perpetuate the cattail stand in mid-pool. The majority of Cutler's Marsh is so deep that it is not of particular value during the breeding-brood rearing season. It is heavily used by migrant waterfowl in the fall.

Pool 2 can be dewatered into Tewaukon to raise that for the winter or held partially full, perhaps at 1150.0. It will probably be best to keep it at 1150.0 and provide for muskrat house building.

Pool 1 (Lake Tewaukon)

The lake is expected to fill up this spring. Stoplogs should be raised as the tailwater comes up to keep the carp barriers from being flooded. We should prevent carp from running into Lake Tewaukon if at all possible.

The level will be dropped to 1147.50 on the heels of the spring runoff. This level will be carried through the summer unless it is higher than the natural riprap along the banks or there is washing above it. If that occurs, the level will be dropped to 1147.0.

We discussed the management level of Lake Tewaukon with North Dakota Fisheries Chief Dale Henegar. We wanted to know if we should have it at 1149.0 or if a lower level would be adequate. He said that to prevent any possibility of winterkill the lake would have to be 20 feet deep. At any shallower level, there would be a possibility of some degree of winterkill.

Tewaukon is very rich in oxygen, however, and so the exact depth is not considered critical for fisheries management. Jon Nelson of Fishery Services says winter kill or partial kill is not necessarily all bad.

As far as holding the lake quite deep "to lessen the possibility of the lake going dry during periods of extreme drought", Tewaukon has been dry only once in the last 60 years, in 1934.

So I consider bank erosion to be our main concern. Elevation 1147.5 should cause less erosion than higher elevations, yet be adequate for use of the boat ramp. If this is not deep enough for the boat ramp, the water could be raised until it is, not exceeding 1148.0. We will observe this during the spring, but plan on holding the lake at 1147.5 unless there is reason for changing it.

II. White Lake Watershed

Spring runoff from the Hepi Lake Watershed from T-2 (Frenier) Dam, will be diverted into Hepi Lake. We should not have a great deal of flooding in the White Lakes. There appears to be about four square miles of watershed for the White Lakes, and we have about 20" of snow on the ground in mid-January. If there is two inches of runoff, that would amount to about 380 acre-feet of water in the White Lakes. We can store this.

Pool 11

Pool 11 is presently at 1147.60. Carp are present and we expect a winterkill.

Pools 11 and 12 are equalized now. When breakup occurs, we will place stoplogs in Dam 11 (and wedge them in place) to get a head of water. We will then place a carp barrier on the stoplogs, this needing a differential to be effective.

We should keep Pool 11 as high as possible, up to 1151.0 if we can, to flood grassland for invertebrate production. The level must not be so high that flooding of Harold Lee's land occurs or that the county road washes. 1150.5 may be as high as we can go.

Pool 11 should not be drawn down for the winter, because of the uncertainty of runoff to fill it in the spring.

Pool 12

Pool 12 is at 1147.60 this winter. It is carp infested and we hope for a winter kill, which may not occur. If it does not winter kill, it should be chemically eradicated. Jon Nelson of Fishery Services has been contacted on this.

Pool 12 should be kept as low as possible in 1969. If a winter kill is obtained, the dead fish will provide fertilizer and so the least amount of water will provide maximum benefits. If a kill is not achieved, less water will mean cheaper chemical eradication. If chemical eradication is not achieved, a low pool that loses about two feet to evaporation is almost certain to freeze out the next winter.

Depending on runoff, we may have to run water from Pool 12 to Pool 2. We should dewater all we can in this way, but will need a carp barrier on Dam 12 during this time.

A portable pump will have to be built or purchased for management of the White Lakes. It will be used to raise Pool 11 from Pool 12 when there is insufficient runoff and to draw Pool 12 down for management reasons. | See plates

III. Hepi Lake Watershed

There will be a heavy runoff from the T-2 watershed reservoir. Hepi Lake should be filled to 1178.0. We thought last year that if we held it to a moderate or low elevation, emergent vegetation might establish and attract nesting diving ducks. This did not occur and Hepi Lake had almost no duck use until the pondweeds set seed. They will do this in eight feet of water as easily as four.

We have also experienced a water shortage and are now convinced that Hepi Lake will be most valuable to use as a reservoir for flooding our smaller pools.

The fertilization effect of rotenoned fish from 1965 has worn off. Duck use is declining. Flooding may increase nutrients in the water and so stimulate invertebrates, pondweeds and duck use.

Pool 10

Runoff from Clarence Breker's barnyard will fertilize this pool. No water will be added from Hepi Lake. Waterfowl use will be compared to Pool 9 again.

Pool 9

This will be tested for minnows with a minnow trap. If they did not winter kill, they will be chemically eradicated. No water will be let in from Hepi Lake. It would do the pool good to dry up.

Pool 7A

Pool 7A has a poor crop of millet standing in it, which we will flood as early in the season as runoff permits. We hope by this to attract and hold pairs of nesting ducks. We do not know what elevation to fill it to, but will determine by inspection where to hold it. It was flooded to 1176.26 in the fall of 1967.

Depending on brood use of Pool 7A and adjacent pools, we should dry it up as soon in the summer as we can, unless there is heavy brood use. The purpose of this will be to try to establish a planting of green rye in the pool bottom, for flooding in the spring of 1970. An August 1st drawdown is likely. Dewatering in steps will concentrate invertebrates and duck use but allow the higher parts of the pool to dry out. If it is too wet to farm, aerial seeding of Japanese millet will be considered.

Pool 7

Pool 7 will be dried up as soon as possible. If it could be seeded to any green crop, the dewatering of Pool 7A in August, plus release from Hepi Lake, could create an invertebrate explosion in Pool 7 during mid-summer.

The winter level should allow for some flooding next spring.

Pool 6

Pool 6 will be kept dry for cattail control. Those that were sprayed should be dead, but we ought to disc the entire cattail bed and let the pool bottom lie fallow for 1969. If it is a suitable seedbed, we will seed Pool 6 to rye in the summer so we have a green crop to flood in 1970.

Pool 5

Pool 5 still has a lot of manure around it. We will flood that as high as we can hold it as early in the spring as possible. This should result in maximum invertebrate populations and high pair use. There will again be heavy pondweed growth and a dense algae mat. I believe this makes Pool 5 unsatisfactory as a walleye rearing pond and so do not expect to try that again this year. I do not believe it would be in conflict with our management, though.

Pool 5 could be slowly dewatered to concentrate invertebrates in mid-August, and dried up. There is no need to carry it through the winter, especially if water is available in Hepi Lake for refilling it the next spring. There is probably a benefit to flooding it in the spring, even if there is no green vegetation to flood.

Pool 3A

Pool 3A should be filled full from Hepi Lake, to about 1156.0. This is carp-free water. It can be carried full into the winter.

Pool 2A

Pool 2A should be flooded completely full, to maximize invertebrate production. Water will come from Hepi Lake through Pool 3A and be carp free. This elevation may be 1154.0 or higher. There probably are minnows in Pool 3A, so a screen or several screens of progressively finer mesh should be used on the inlet tube in Dike 3 to keep minnows out, if possible. These screens will require frequent cleaning, maybe even constant attendance.

After flooding Pool 2A as full as we can get it, some water should be drawn off after perhaps two weeks, through screened stoplogs. This will result in a nearly full pool with some floodable grass. The pool will be kept moderately full over winter to encourage muskrat house building.

SPRAGUE LAKE UNIT

Sprague Lake

As there are no controls on this lake management of the water level is not possible.

If water in Sprague Lake reaches high levels water can be diverted into the marshes to the west and south of the Lake, with carp screening.

Mann Lake

This lake is directly connected to the Wild Rice River and no water controls are available for regulating lake elevations. No management of water levels will be possible in 1969.

January 29, 1969

Herbert G. Troester

Herbert G. Troester
Refuge Manager

1968 Easement Refuge Water Use - Tewaukon District

Only one inspection of Bonehill Refuge was made during the year. This was in July. At this time the pool held good water, the level being up considerably from last year when a drought hit the area. We hope to install a more permanent water gauge here in 1969.

The Maple River Refuge was field checked twice during the spring, in March and early May. Water held by the new structure was 1¼" below the spillway in March and was running out about six inches deep in May. In checking the refuge this fall we found the marsh to be almost full.

Water levels in Lake Elsie Refuge, which were highest ever in the spring of 1967, receded about one and one-half feet during the dry July and August weather. However, fall rains brought the lake elevation up about .3'.

Water levels in Storm Lake Refuge were normal and about the same as last year although the lake elevation was higher this fall than in 1967.

Water conditions on the Wild Rice River Refuge were poor this year. No water flowed out of the Tewaukon outlet and the river channel was all but dry after mid-July. No use of the area by waterfowl was noted.

Easement Refuges, Consumptive Water Use For 1968

Refuge	A Avg. Annual Evap.	B 1968 Lake Rise	C Net Gain A+B	D Surface Acres	E Ac-Ft Gain CxD	F Outflow in Ac-Ft	G Total Inflow Ac-Ft E+F
Bonehill	2.65'	(1)2.00	4.65	40	186	Unk.	Unk.
Lake Elsie	2.65'	(2)-.50	2.15	317	682	Unk.	Unk.
Maple River	2.65'	(3)4.00	6.65	93	618	Unk.	Unk.
Storm Lake	2.65'	(1) .30	2.95	181	534	Unk.	Unk.
Wild Rice	2.65'	.00	2.65	3	8	840	840

(1) Estimated.
(2) Water 26½" below first "I" beam on NW corner of road bridge on 11-1-67; 32½" below on 11-1-68.
(3) Estimated, with new structure water is considerably higher than last year.

Physical Condition of Control Structures

Bonehill Refuge

Good condition, see photos in 1966 report.

Lake Elsie Refuge

There are no control structures on this area.

Maple River Refuge

New dam built in 1967 is in excellent condition. Small structure north of new dam is largely ineffective.

Storm Lake Refuge

Control structure ineffective.

Wild Rice River Refuge

Abandoned beaver dam only.

THE 1968 AQUATIC VEGETATION SURVEY

Introduction

The aquatic plant transects were begun on August 21, 1968 and completed on September 19, 1968. Eleven new transects were added this year: Pool 2A, Pool 3A, Pool 3 (1,2), Pool 4 (1,2), Pool 7, Cutler's Marsh #4, Mud Slough, Lake Tewaukon and Skroch's Bay.

Since there are now more transects, a more efficient method was needed. In order to save time the wire was not used on the larger bodies of water and the distances were estimated. It was felt that this would give a general picture of the vegetation present, the relative amounts, the depth, and any changes taking place. The wire was still used on the smaller pools.

THE INDIVIDUAL TRANSECTS

Cutler's Marsh #1 - water elevation 1150.80. Avg. depth 5.5' 8-23-68

This transect covered mostly clear open water with some filamentous algae present. The starting shoreline had about a 15' band of Typha latifolia and both shorelines had scattered patches of Scirpus validus and S. fluviatilis. Wire used.

Cutler's Marsh #2 - 1150.80. Avg. depth 3.5'. 8-29-68.

A dense band of Typha angustifolia extends out from the north side for about 65' and then continues on in a broken pattern to 600' out. Utricularia vulgaris is scattered throughout with some dense beds. There is some filamentous algae in the slightly murky water. Scattered amounts of Lemna minor, Polygonum coccineum, Scirpus fluviatilis and algae mats appear on the shorelines. Wire used.

Cutler's Marsh #3 - 1150.60. Avg. depth 3.5'. 9-6-68.

Heavy stands of Typha latifolia and T. angustifolia dominate the transect. Decayed vegetation (mostly cattails) lines the shorelines. Small patches of Phalaris arundinacea and Scirpus fluviatilis are found among the cattails. Utricularia vulgaris, Ceratophyllum demersum, Lemna minor are present in small amounts. Some Russian Olive trees line the finish shoreline. The water is slightly cloudy due to much carp activity. Wood duck use is heavy here. Wire used. (Field notes say the average depth was four feet, but no soundings were recorded.)

Cutler's Marsh #4 - 1150.80. Avg. depth 6.5'. 8-23-68.

This transect is across the big deep arm at the east side. No aquatic vegetation is present along the transect except for a light amount of evenly distributed filamentous algae. The shorelines have about a 15' band of mostly S. fluviatilis and S. validus with some Spartina pectinata and Phragmites communis mixed in. A few algae mats are present on the finish shoreline. The water is relatively clear. Wire not used.

East White Lake #1 - 1148.05. Avg. depth 4.7'. 8-21-68.

The transect is barren of any aquatic vegetation except for a 5' band of Scirpus americanum at the finish shoreline and a small patch of the same east of the starting point. Both shorelines are rocky. The water is relatively clear and has much carp activity. Wire used.

West White Lake #2 - 1149.90. Avg. depth 1.9'. 8-22-68.

Open water predominates over the first half of this transect until about station #9 where a rather dense stand of mostly S. validus and S. fluviatilis begins and continues on to the finish stake. A heavy stand of T. latifolia is present west of station #9. There is also a 25'x100' patch of dead cattail east of this station. U. vulgaris is moderately dense throughout the Scirpus and Typha stand. Several small beds of Potamogeton pectinatus are scattered between stations #3 and #4 with some P. communis and P. coccineum near the finish shoreline. The water is fairly clear with much carp activity. Wire used.

Hepi Lake (Pool 8) - 1173.90. Avg. depth 2.9'. 9-6-68.

A 20' band of decomposed P. pectinatus encircles the lake on the rock shoreline. Many large P. pectinatus beds are evenly spread along the transect and throughout the lake, while small patches of P. richardsonii can be found just off the starting shore. Narrow bands (5') of S. acutus, P. arundinacea and Cyperus erythrorhizos circle the lake. Small patches of Polygonum coccineum and Rumex verticillatus are widely scattered along the shore. The water is quite muddy, from feeding ducks. No early duck use was noted but with maturing of Sago, use became heavy. Wire was used.

Pool #9 - Avg. depth 2.0'. 8-26-68.

A few scattered patches of Alisma gramineum and P. pectinatus occur along the transect and throughout the pool. Some Myriophyllum verticillatum was encountered in small amounts away from the transect. The starting shoreline has a 25' band of T. latifolia while the finish shoreline has 10' bands of S. fluviatilis and P. arundinacea preceded by a 10' mud flat. Small patches of Sagittaria latifolia, P. coccineum, S. pectinata and Echinochloa pungens are scattered about the shoreline. Wire used.

Pool #10 - Avg. depth 2.2'. 8-27-68.

This pool appears void of submergent vegetation. The water is muddy and algae mats cover the shore. A 10' band of S. fluviatilis and a 15' band of P. arundinacea encircles the pool. The shoreline contains scattered amounts of R. verticillatus, T. angustifolia, S. acutus and S. validus. Yet this same pool commonly had 35 redhead ducks on it early in the summer. They were most likely feeding on invertebrates. This pool receives runoff from Clarence Breker's barnyard. A sample of water and invertebrates was taken during the summer. Wire used.

Pool #7 - 1170.86. Avg. depth 1.5'. 9-11-68.

Submergent vegetation is quite dense along the transect and throughout the pool. It consists mostly of P. pusillus and M. verticillatum with some Zannichellia palustris and Potamogeton foliosus. Algae mats are very numerous both in the water and at pool's edge. A 20' band of T. latifolia surrounds the pool. Small patches of Alisma plantago-aquatica, P. coccineum, P. arundinacea, C. erythrorhizos, S. validus, S. fluviatilis and R. verticillatus are scattered about the shore. The water is clear. Wire not used.

Pool #6 - 1166.78. Avg. depth 1.3'. 8-30-68.

A thick band (75-100') of T. angustifolia interspersed with some T. latifolia dominates most of the shoreline. Dense beds (20x30') of P. pectinatus are scattered throughout the pool. The north 200' of the pool has a heavy concentration of Ceratophyllum demersum. L. minor occurs in dense beds in a few spots. Wire used.

Pool #5 - 1161.22. Avg. depth 1.2'. 8-30-68.

This pool was heavily fertilized with manure to encourage invertebrate growth. As a result of this fertilization aquatic plant growth appears to have exceeded that of past years. Lemna trisulca and P. pectinatus are extremely heavy throughout, although little appears at the transect stations. Some P. richardsonii and C. demersum is present in small amounts. Algae mats are numerous with the west end being almost one solid mat. The starting shoreline has a 15' mixed band of T. latifolia and T. angustifolia and the finish shore an 80' band. Scattered patches of S. latifolia, S. acutus, S. fluviatilis, A. plantago-aquatica and P. coccineum occur along the edges of the pool. Wire used.

Pool 3A - 1152.60. Avg. depth 0.8'. 9-5-68.

The transect runs almost diagonally through the outer margin of the pool. This margin is made up mostly of S. validus with scattered amounts of T. latifolia, S. fluviatilis and A. plantago-aquatica. L. minor is fairly heavy here with some traces of L. trisulca. The inner marsh (100x300') is characterized by Scirpus debilis and some A. plantago-aquatica, S. validus, and algae mats. The starting shoreline has the same vegetation present in the outer margin while the finish shore is a rock dike banded by sunflowers. P. pectinatus is rather dense for about the last 150' of transect. Wire used.

Pool 2A - Dry except for a little water in the ditch. 9-4-68.

The transect shows this pool to be a dried out marsh consisting of one mass of T. angustifolia and T. latifolia with some S. acutus, S. validus, P. coccineum, Sparganium eurycarpum, S. fluviatilis, S. latifolia and A. plantago-aquatica scattered in. There are three large open areas (about 100x250') spaced evenly along the transect. A dike forms the finish shoreline. Wire used.

Pool 4 - 1157.45. Avg. depth 2.0'. 9-11-68. Transect 1.

This transect starts from a rock dike. There is a five foot mud flat with small patches of S. latifolia and Bidens comosa tapering off into a T. angustifolia stand about 100x200'. The transect runs through thin scattered stands of P. coccineum, T. angustifolia, T. latifolia, S. acutus, S. eurycarpum, and Eleocharis sp. L. minor occurs in minute amounts and L. trisulca is very heavy within about 10' of the finish shoreline. This pool was newly flooded this spring. Wire not used.

Pool 4, Transect 2 - 1157.45. Avg. depth 0.7'. 9-16-68.

The first 100' of the stransect is a grass-covered peninsula and the remainder is a shallow open-water area whose mud bottom is moderately covered with L. trisulca and algae mats. Some C. demersum may be found between the 300 to 800' mark. L. trisulca almost solidly covers the bottom the last 200' of the transect. A few widely scattered P. coccineum, T. angustifolia, and Eleocharis sp. may be found near the finish. The water is clear. Wire not used.

Pool 3, Transect 1 - 1153.00. Avg. depth 2.1'. 9-16-68.

This transect can be divided into two parts. The first half is good marsh with moderately dense and evenly distributed amounts of P. coccineum and S. fluviatilis with some T. latifolia, P. arundinacea, and S. eurycarpum interspersed. The Wild Rice River crosses the transect twice, once at about 325' and again at about 440'. A 35' band of mostly S. fluviatilis, some P. coccineum, and some P. arundinacea is found on both sides of the river. The next half of the transect consists of a shallow open water area with mud bottom and a bare mud flat extending about 150' from shore. A few scattered small clumps of T. latifolia, P. arundinacea, and Eleocharis Sp. occur near shore. Wire not used.

Pool 3, Transect 2 - 1153.00. 9-19-68.

The transect covers a mostly dry grassy area. The first 400' is open grass meadow with scattered amounts of Panicum virgatum, S. pectinata, R. verticillatus, Glycyrrhiza lepidota, Hordeum jubatum, Symphoricarpos occidentalis, T. angustifolia and P. arundinacea. The Wild Rice River cuts through the transect at about 75'. There is a 5' band of S. fluviatilis on both sides of the river. The

next 200' is an almost solid stand of P. arundinacea with an open 50x100' flooded area moderately covered with L. minor. There are a few scattered small clumps of S. validus, Scirpus subterminalis, S. fluviatilis, S. americanus, S. pectinata, Eleocharis sp. and T. angustifolia. Next there is a 100' stand of S. fluviatilis with the river channel coming through at the 700' mark, a 75' open grass area, and a 100' stand of almost solid S. pectinata. The last 75' is flooded 0.4' deep with an even distribution of S. fluviatilis, P. arundinacea, P. coccineum, T. latifolia, Eleocharis sp., and S. debilis. Predominate plants throughout the transect are: P. arundinacea, S. pectinata and S. fluviatilis. Wire not used.

Mud Slough (part of Pool 3) - 1152.80. Avg. depth 4.5'. 9-10-68.

Potamogeton pusillus is thinly scattered in the middle of the lake along the transect route. A 15 to 20' band of S. fluviatilis with P. coccineum scattered throughout and a 5 to 10' band of S. pectinata rims the water. There is a 5 x 40' clump of Salix interior on the south shore and scattered shoreline patches of S. acutus. The water is quite muddy. Wire not used.

Lake Tewaukon - 1146.05. Avg. depth 6.5'. 9-6-68.

The lake has a heavy concentration of filamentous algae but lacks both submergent and emergent aquatic vegetation except for a few traces of P. coccineum at the east end. A rock shoreline and high grass and tree covered banks surround most of the lake. The water is cloudy and has many carp. Wire not used. Depth readings across the west end of the east arm of the lake from south to north were: 6.0', 8.0', 7.5', 7.0', and 3.5'.

Skrooh's Bay - 1146.05. Avg. depth 2.0'. 9-6-68.

The bay is essentially barren of all aquatic vegetation but there is a broken band of mixed cattail around part of the sandy shore. The water is extremely muddy due to the high concentration of carp. Wire not used.

These transects were run mainly by Wildlife Aide Alger van Hoey.

Herbert G. Troester
Refuge Manager